Effects of Executive Function and Anger Coping on Occurrence of Anger

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Abstract

It was examined in this research whether there is a relationship with occurrence of anger, anger coping and executive function. It was assumed that anger was controlled by the executive function, that anger was reduced by anger coping and that anger coping was controlled by executive function. Students took three questionnaires including "Anger", "Anger coping" and "Executive function" questionnaire. The result showed that the main effect and the interaction of executive function were not significant and that there was no significant correlation between executive function and anger. On the other hand, the results showed that correlation between anger and anger coping was significant. The result of multiple regression coefficients showed that three factors of anger coping, including Emotion expression, Emotional support seeking and Cognitive reinterpretation, regressed to anger as independent variables. Furthermore, some of correlation coefficients between anger coping and executive function were significant. These results indicate that anger coping controls anger, but does not the executive function and that coping is closely related to executive function. It suggests that it is difficult to reduce anger with just execution function without coping, because anger coping controls anger directly and concretely but execution function controls anger indirectly.

Key words: *executive function, anger, anger coping, emotion expression, emotional support seeking, cognitive reinterpretation*

Introduction

In daily life such as child rearing and school life, we face various stress and often feel anger. Abe & Takagi (2006) showed that self-centered behavior, insulting / rude manner, etc. are causes of anger. When we face stress, we feel anger and turn anger towards others. However, turning anger directly to others causes trouble in social life. It is very important to intentionally control and suppress anger when we feel angry and dissipate anger. How many people feel angry and

suppress anger? Hatakeyama, Sasaki & Yoneyama (2018) showed in a study that examined the stress of nurses in hospitals that when a nurse feels anger in response to a patient, 79.1% of nurses suppress anger. It suggests that self-control is important factor to suppress anger. Anger management to control anger has also been devised and used in many schools and companies (e.g., Kemp, & Strongman, 1995; Novaco, 1975).

In this research, we focus on executive function and anger coping as an important role in suppressing anger and examine the mechanism of anger occurrence. It was clarified how anger occurs and how its anger is controlled and resolved.

Anger coping is behavior that control anger and properly copes with stress. What kind of behavior does anger coping have? Sasaki & Yamasaki (2002) is supposed to have four anger copings. The four copings are Emotion expression, Emotional support seeking, Cognitive reinterpretation and Problem solving. Emotion expression is behavior to show your feelings with expressions and attitudes when you feel anger. Emotional support seeking is behavior to calm yourself by communicating with people. Cognitive reinterpretation is a way to reinterpret it as a good one when it comes to an unpleasant incident. Problem solving is behavior to solve the problem that is developing anger. Sasaki & Yamasaki (2002) proposed GCQ (the General Coping Questionnaire) based on these assumption that consist of four categories including emotion expression, emotional support seeking, cognitive reinterpretation and problem solving.

Next, we discuss the definition and structure of executive function. The executive function is a cognitive control function that controls his or her thinking and behavior when performing tasks. Several models are assumed for the executive function. Miyake et al., (2000) assume that the executive function is composed of three elements, updating, shifting and inhibition. Updating is a function of monitoring information on tasks and replacing with information appropriate for tasks. Shifting is a swiching function of attention to switch attention or switching from one way to another different method. Inhibition is a function that intentionally suppresses dominant automatic reactions if necessary. Sekiguchi & Yamada (2017) propose EFG (Executive function Questionnaire) on the basis of model of executive function assumed in previous research and knowledge on question paper. EFG consists of six elements including Shifting, Updating, Inhibition, Planning, Monitoring and Absorption.

Is the executive function able to control or reduce anger? Sekiguchi & Tanno (2006) examined the relationship between anger and executive function. The results showed that there was a significant relationship between anger and executive function. Olson, Sameroff, Kerr, Lopez & Wellman (2005) also examined the relationship between executive function and anger in young children. The result showed that even in young children there was a significant relationship between

anger and executive function. These results suggest that the executive function can control or reduce anger

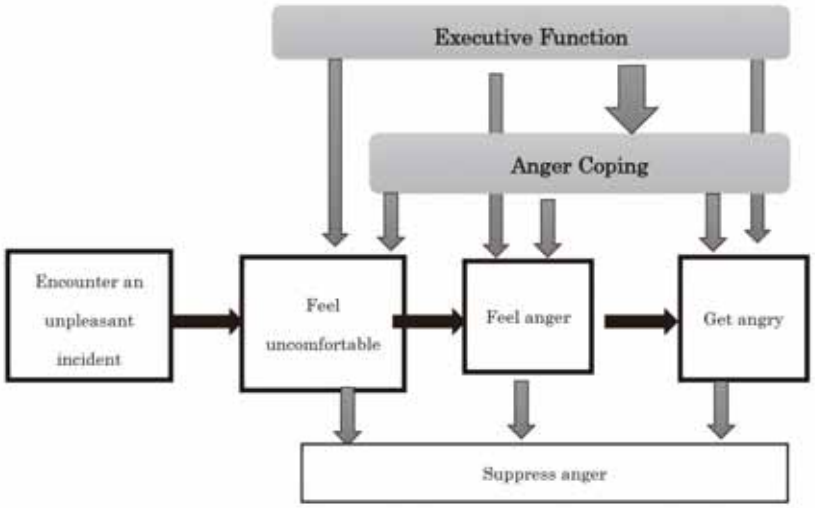

Figure 1 Model of relations on anger, anger coping and executive functions examined in this study

It was examined in this research whether there is a relationship with anger, anger coping and executive function with university students as participants. A mental model including anger, executive function and coping as shown in Figure 1 was assumed. It was assumed in the model that (1) anger is controlled by the executive function, that (2) anger is reduced by anger coping and that (3) anger coping is controlled by executive functions. It was expected the occurrence and reduction of anger depend on coping and executive functions if anger is a dependent variable and anger coping and executive functions are independent variables.

Method

Participants:

Participants were sixty university students, consisting 38 male student and 22 female students. Their mean age was 19.38 years old and the age range was 18 to 22 years old.

Design

In this study, research was designed to verify the relationship between anger, anger coping, and executive function, with anger occurrence as dependent variable, anger coping and executive function as independent variables.

Materials and Procedure

Students took three questionnaire including “Anger“, “Anger coping” and “Ex

ecutive function" questionnaire. Students were asked to grade according to four ranks (from 1 to 4) on their behavior and thought using the Anger Questionnaire (Suzuki & Haruki, 1994). The Anger Questionnaire is composed of twenty questions. For example, questions were "I am short-tempered", "I am easy to get angry", "I feel angry when condemned in public" and so on.

Students were asked to grade according to four ranks (from 1 to 4) on their behavior and thought using the Executive Functions Questionnaire (EFQ) that consist of six categories (Sekiguchi & Yamada, 2017). The EFQ is composed of twenty four questions. It consists of four items in each of six categories, including the Shifting, Updating, Inhibition, Planning, Monitoring and Absorption. For example, questions in Shifting were "I am good at providing ideas", "I can simultaneously manage well even if I received consultation from multiple people", "I worry about how people respond to my remarks" and so on. Questions in Updating were "I can manage things corresponding to the situations and others even if there is a problem", "I can easily follow talking even if the topics change", "I can adapt my behaviors according to the surroundings" and so on. Questions in Inhibition were "I can steadily take in new ideas", "I can organize my work plan w ell"," I do not forget promises meeting people" and so on. Questions in Planning were "I can continuously conceive if I think about fun things", "I am not good at working on long-term planning", " I pay close attention to my own appearance in people's eyes" and so on. Questions in Monitoring were "I can simultaneously proceed multiple things", "I am good at organizing", "I am always aware of my behaviors" and so on. Questions in Absorption were "I tend to concentrate only one thing", "I tend to make plans for schedules with deadlines", "I would be obsessed if I am interested in one thing" and so on.

In "Anger coping" questionnaire, students were asked to grade according to four ranks (from 1 to 4) what kind of actions they do when they feel angry using the GCQ (the General Coping Questionnaire) that consist of four categories (Sasaki & Yamasaki, 2002). The GCQ is a questionnaire consisting of thirty two questions. It consisted of eight items in each of four categories, including the Emotion expression, Emotional support seeking, Cognitive reinterpretation, and Problem solving. For example, questions in Emotion expression were "I express my unpleasant feelings", " I express my thinking with attitude", "I express my unpleasant with attitude" and so on. Questions in Emotional support seeking were "I am encouraged from familiar people", "I am supported for my feelings by familiar people", "I try to address kind words from someone" and so on. Questions in Cognitive reinterpretation were "I try to see the bright side of the situ ation", "I try to interpret the problem in a good direction", "I try to find a bright element in the problem" and so on. Questions in Problem solving were "I try to work hard to solve occurred occasions", "I concentrate on problemsolving",

"I try various things to break the bad situation" and so on.

These questions have been printed on two A4 papers with the content of research ethics, research purpose and attribution such as age, sex and sibling relation of participants. The survey was conducted in a group. We distribute the paper to participants and asked them to answer on questions at their own pace. Before their answering the question, we explained the purpose of this survey, strict protecting of the secrecy of data, and disclosure to academic societies to participants. For this investigation, we informed the students that they have the right to refuse the investigation, there is no need to submit a questionnaire if students do not want to participate in the survey. The response time was about 15 minutes.

Results

Answers to the questionnaire were examined on analyzing the data. An answer of one participant was incomplete so that the data of this participant was deleted.

1. Effects of All executive functions and Anger Coping on Anger

Firstly, ANOVA was performed how the executive function and anger coping affect anger. The mean scores of anger coping was 81.63 (SD=9.05). We classified with anger coping score of 82.00 or more as "High coping" and participants with score less than 81.00 as "Low coping". The mean scores of all executive functions (ALL EF) including six factors was 65.51 (SD=6.80). We classified participants with high executive function score of 66.00 or more as "High executive function" and participants with score less than 65.00 as "Low executive function". Based on the anger coping and executive function scores, participants were classified into four groups, including "High coping/High EF", "High coping/Low EF", "Low coping /High EF" and "Low coping/Low EF" group. Participants in "High coping/High EF" group had high anger coping and high executive function. Participants in "High coping/Low EF" group had high anger coping and low executive function. Participants in "Low coping/High EF" group had low anger coping and high executive function. Participants in "Low coping/Low EF" group had low coping and low executive function. As a result, there were 19 participants in High coping/High EF group, 13 participants in High coping/Low EF group, 14 participants in Low coping/High EF group and 13 participants in Low coping/Low EF.

Table 1 indicates the mean and standard deviation of anger score as functions of anger coping and executive function. A two-way ANOVA for anger coping and executive function was performed. Table 2 is the result of ANOVA. The analysis revealed that main effects for Coping ($F(1,55) = 2.03$) and Executive function ($F<1.00$) were not significant. The interactions was also not significant ($F(1,55) = 2.57$).

Table 1
The mean and standard deviation of Anger score as functions of Anger coping and Executive function.

	Low Coping		High Coping	
	Low EF	High EF	Low EF	High EF
Mean	20.46	22.14	24.69	21.89
SD	4.09	5.29	4.87	5.75

Table 2
ANOVA as Anger coping and Executive functions on Anger score

Source	SS	*df*	MS	F
Anger Coping	57.08	1	57.08	2.03
All EF	4.48	1	4.48	0.16
Coping x EF	72.18	1	72.18	2.57
error	1545.5	55	28.10	

Note: $+p<.10$ $*p<.05$ $**p<.01$.
Note: All EF is executive function including six elements.

2. Effects of Basic Executive Function and Anger Coping on Anger

Miyake et al. (2000) assume that the executive function is composed of basic three elements including updating, shifting and inhibition. Therefore, we analyze the basic executive functions that consist of three elements as Basic effective function (Basic EF).

Table 3 indicates the mean and standard deviation of anger score as functions of anger coping and Basic executive function. A two-way ANOVA for anger coping and Basic executive function was performed. Table 4 is the result of ANOVA. The analysis revealed that main effects for Anger coping ($F(1,55) = 1.66$) and Executive function ($F<1.00$) were not significant. The interactions was not significant ($F<1.00$).

Table 3
The mean and standard deviation of Anger score as functions of Anger coping and Basic Executive function

	Low Coping		High Coping	
	Low EF	High EF	Low EF	High EF
Mean	21.21	21.46	23.92	22.42
SD	4.41	5.23	5.50	5.56

Table 4
ANOVA as Anger coping and Basic Executive functions on Anger score

Source	SS	*df*	MS	F
Anger Coping	48.42	1	48.42	1.66
Basic EF	5.67	1	5.67	0.19
Coping x EF	11.01	1	11.01	0.38
error	1607.14	55	29.22	

Note: +p<.10 *p<.05 **p<.01.
Note: Basic EF is executive function including three elements.

3. Correlations between Anger and Anger coping.

Table 5 indicates the correlation coefficients between anger and four factors of anger coping. The analysis reveals that anger was significantly correlated with Emotion expression (p<.01).

Also, it reveals that the correlation coefficient between Anger and Emotional support seeking and the correlation coefficient between Anger and All Coping were marginally significant (ps<.10).

Table 5
Correlation coefficient between Anger and Anger Coping

	Emotion expression	Emotional support seeking	Cognitive reinterpretation	Problem solving	All Coping
Anger	0.485**	0.223+	-0.229+	0.009	0.244+

Note: +p<.10 *p<.05 **p<.01

4. Correlations between Anger and Executive function.

Table 6 indicates the correlation coefficients between anger and six factors of executive function. The analysis reveals that none of the correlation coefficients was significant.

Table 6
Correlation coefficients between Anger and All executive functions

	Shifting	Updating	Inhibition	Planning	Monitoring	Absorption	All EF	Basic EF
Anger	-0.128	-0.043	-0.094	-0.028	0.067	0.161	-0.015	-0.115

Note: +p<.10 *p<.05 **p<.01

5. Correlations between Anger coping and Executive function.

Table 7 indicates the correlation coefficients between anger coping and executive function. The analysis reveals that Cognitive reinterpretation was significantly correlated with Shifting, Updating and Basic executive function (*ps*<.05), that Problem solving was significantly correlated with Planning (*p*<.01) and that All anger coping was significantly correlated with Shifting (*p*<.05).

Also, the analysis reveals that Emotional support seeking was marginally significantly correlated with Planning, Monitoring and Absorption, that Cognitive reinterpretation was marginally significantly correlated with All executive functions, and that All anger coping was marginally significantly with Shifting and Basic executive function (*ps*<.10).

Table 7
Correlation coefficients between Anger coping and Executive function

	Emotion expression	Emotional support seeking	Cognitive reinterpretation	Problem solving	All anger coping
Shifting	0.109	-0.060	0.275*	0.309*	0.225+
Updating	0.009	0.059	0.324*	0.326*	0.258*
Inhibition	-0.078	-0.001	0.160	0.093	0.054
Planning	-0.032	-0.254+	0.140	0.340**	0.032
Monitoring	-0.176	0.227+	0.043	0.058	0.060
Absorption	-0.065	0.237+	-0.019	0.119	0.113
All EF	-0.056	0.069	0.237+	0.321*	0.200
Basic EF	0.024	-0.010	0.308*	0.298*	0.219+

Note: +*p*<.10 *p<.05 **p<.01

6. Multiple regression analysis.

(1) Anger as dependent variable and Anger coping and All executive functions as Predictors

A multiple regression was run to predict Anger from Anger coping and All executive functions. Table 8 is the Model Summary table. Table 9 indicates the result of ANOVA. Table 10 indicates the Coefficients. These variables statistically did not significantly predict Anger (F (2, 58) = 1.91, p = 0.16, R2 = .030). All two variables were not statistically significantly to the prediction.

Table 8

Model Summary table with Anger as dependent variable and with Anger coping, All executive functions as Predictors

Model Summary	
R	0.253
R2 (R Square)	0.064
R2 (Adjusted R Square)	0.030
Standard Error of Estimate	5.279
The number of Participants	59

a. Predictors: (Constant), Anger coping, All executive functions.

Table 9

ANOVA with Anger as dependent variable and with Anger coping, All executive functions as Predictors

Model	*df*	Sum of Squares	Mean Square	F	Significant
Regression	2	106.311	53.155	1.907	0.158
Residual	56	1560.875	27.873		
Total	58	1667.186			

a Dependent Variable: Anger
b Predictors: (Constant), Coping, All executive functions.

Table 10

Coefficients with Anger as dependent variable and with Anger coping, All executive functions as Predictors

	Unstandardized Coefficients		t	Sig	95.0% Confidence interval for B	
	B	Std.Error			Lower Bound	Upper Bound
(Constant)	13.243	8.381	1.580	0.120	-3.547	30.032
Coping	0.152	0.078	1.950	0.056	-0.004	0.309
All EF	-0.052	0.104	-0.503	0.617	-0.261	0.156

a Dependent Variable: Anger

(2) Anger as dependent variable and Anger coping and Basic Executive function as Predictors

A multiple regression was run to predict Anger from Anger coping and Basic executive function. Table 11 is the Model Summary table. Table 12 indicates the result of ANOVA. Table 13 indicates the Coefficients. These variables statistically did not significantly predict Anger (F (2, 58) = 2.75, p = 0.073, R2 = .057).

All variables did not add statistically significantly to the prediction.

Table 11

Model Summary table with Anger as dependent variable and with Anger coping, All executive functions as Predictors

Model Summary	
R	0.299
R2 (R Square)	0.089
R2 (Adjusted R Square)	0.057
Standard Error of Estimate	5.207
The number of Participants	59

Table 12

ANOVA with Anger as dependent variable and with Anger coping, Basic Executive function as Predictors

Model	*df*	Sum of Squares	Mean Square	F	Significant
Regression	2	149.124	74.562	2.751	0.073
Residual	56	1518.062	27.108		
Total	58	1667.186			

Table 13

Coefficients with Anger as dependent variable and with Anger coping, All executive functions as Predictors

	Unstandardized Coefficients		t	Sig	95.0% Confidence interval for B	
	B	Std.Error			Lower Bound	d Coefficients
(Constant)	15.254	7.142	2.136	0.037	0.947	29.561
Coping	0.168	0.077	2.164	0.035	0.012	0.323
BasicEF	-0.213	0.157	-1.356	0.180	-0.529	0.102

(3) Anger as dependent variable and 4 factors of Anger coping and 6 factors of Executive function as Predictors

A multiple regression was run to predict Anger from 4 factors of Ager coping and 6 factors of executive function. Table 14 is the Model Summary table. Table 14 indicates the result of ANOVA. Table 15 indicates the Coefficients. These variables statistically significantly did not predict Anger, (F (2, 58) = 3.40, p = 0.002,

R2 = .293). Three variables including Emotion expression Emotional support seeking and Cognitive reinterpretation were marginally statistically significantly to the prediction.

Table 14

Model Summary table with Anger as dependent variable and with four factors of Coping and six factors of Executive function as Predictors

Model Summary	
R	0.644
R2 (R Square)	0.415
R2 (Adjusted R Square)	0.293
Standard Error of Estimate	4.509
The number of Participants	59

Table 15

ANOVA with Anger as dependent variable and with four factors of Anger coping and six factors of Executive function as Predictors

Model	*df*	Sum of Squares	Mean Square	F	Significant
Regression	10	691.179	69.118	3.399	0.002
Residual	48	976.007	20.333		
Total	58	1667.186			

Table 16

Coefficients with Anger as dependent variable and with four factors of Anger coping and six factors of Executive function as Predictors

	Unstandardized Coefficients		t	Sig	95.0% Confidence interval for B	
	B	Std.Error			Lower Bound	Coefficients
(Constant)	3.923	8.289	0.473	0.638	-12.744	20.590
Emotion expression	0.618	0.153	4.036	0.000	0.310	0.926
Emotional support seeking	0.333	0.179	1.858	0.069	-0.027	0.693
Cognitive reinterpretation	-0.476	0.253	-1.877	0.067	-0.985	0.034
Problem solving	0.179	0.270	0.661	0.512	-0.365	0.722
Shifting	-0.556	0.366	-1.517	0.136	-1.292	0.181
Updating	0.138	0.512	0.270	0.789	-0.892	1.168
Inhibition	-0.135	0.419	-0.322	0.749	-0.977	0.707
Planning	0.606	0.510	1.189	0.240	-0.419	1.631
Monitoring	0.042	0.413	0.102	0.919	-0.789	0.873
Absorption	0.471	0.395	1.192	0.239	-0.324	1.265

(4) Anger as dependent variable and three factors of Anger coping as Predictors

Then, three factors, Emotion expression, Emotional support seeking and Cognitive reinterpretation, which were significant in the previous multiple regression analysis, were chosen and multiple regression analysis was performed using them as explanatory variables. Table 17 is the Model Summary table. Table 18 indicates the result of ANOVA. Table 19 indicates the Coefficients.

The general form of the equation to predict anger from coping and executive function is predicted

Anger =1 3.87 + 0.558 x Emotion expression + 0.229 x Emotional support seeking - 0.483 x Cognitive reinterpretation

These variables statistically significantly predict Anger (F (3, 58) = 9.72, p = 0.000, R2 = .311). These three variables of anger coping were statistically significantly to the prediction.

Table 17

Model Summary table with Anger as dependent variable and with three factors of Anger coping as Predictors

Model Summary	
R	0.589
R2 (R Square)	0.346
R2 (Adjusted R Square)	0.311
Standard Error of Estimate	4.451
The number of Participants	59

Table 18

ANOVA with Anger as dependent variable and with three factors of Anger coping as Predictors

Model	*df*	Sum of Squares	Mean Square	F	Significant
Regression	3	577.465	192.488	9.715	0.000
Residual	55	1089.722	19.813		
Total	58	1667.186			

Table 19
Coefficients with Anger as dependent variable and with three factors of Anger coping as Predictors

	Unstandardized Coefficients		t	Sig	95.0% Confidence interval for B	
	B	Std.Error			Lower Bound	Coefficients
(Constant)	13.967	5.066	2.757	0.008	3.815	24.119
Emotion expression	0.558	0.143	3.888	0.000	0.270	0.845
Emotional support seeking	0.399	0.152	2.621	0.011	0.094	0.704
Cognitive reinterpretation	-0.483	0.193	-2.499	0.015	-0.871	-0.096

Discussion

It was examined in this research the relationships among anger, anger coping and executive function. Firstly, the results on the relationship between anger and executive function were as follows. The result of ANOVA showed that both the main effect and the interaction of executive function were not significant. In addition, there was no significant correlation between executive function and anger. These results suggest that there is no relationship between anger and executive function.

Secondary, the relationship between anger coping and anger was as follows. Correlations between anger and anger coping were significant. Even in the multiple regression coefficient, the effect of anger coping was significant. The result of multiple regression coefficients showed that three factors of anger coping including Emotion expression, Emotional support seeking and Cognitive reinterpretation, regressed to anger as independent variables. These results suggest that anger coping controls anger, especially Emotion expression, Emotional support seeking and Cognitive reinterpretation reduce anger.

By the way, some of correlation coefficients between anger coping and executive function were significant. In particular, Cognitive reinterpretation of anger coping was significantly related with Shifting, Updating and Planning of executive function. Problem solving was significantly related with Shifting and Updating. Emotional support seeking was significant related with Planning, Monitoring and Absorption. These results suggest that anger coping is closely related to executive function.

The results of this study show that coping controlled anger, but did not the executive function. Figure 2 reflects the result. These results suggest that executive functions are necessary to make coping function for anger. However, it is suggesting that it is difficult to reduce anger with just execution function without anger coping, because anger coping had a considerable influence on anger but

execution function controls anger indirectly.

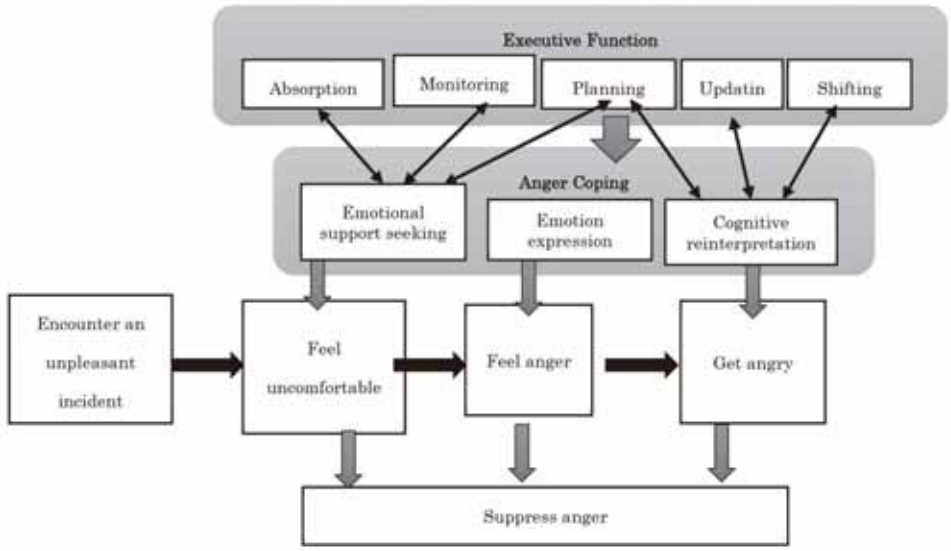

Figure 2
Modified model based on research results

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